Supporting Information

Redox molecule Alizarin Red S anchored on biomass-derived porous carbon for enhanced supercapacitive performance

Yuanhai Bao[1,2], Hui Xu[1,2*], Pengdong Chen[1,2], Yuanqiang Zhu[1,2], Shasha Zuo[1,2], Xiuqing Kong[1,2], Yong Chen[1,2*]

1. College of Petrochemical Engineering, Lanzhou University of Technology, Lanzhou, China.
2. Key Laboratory of Low Carbon Energy and Chemical Engineering of Gansu Province，Lanzhou, China

Hui Xu (corresponding author)
E-mail address: xuhui@lut.cn
Tel: +86-931-2975872
Yong Chen (corresponding author)
E-mail address: yongchen2003@126.com

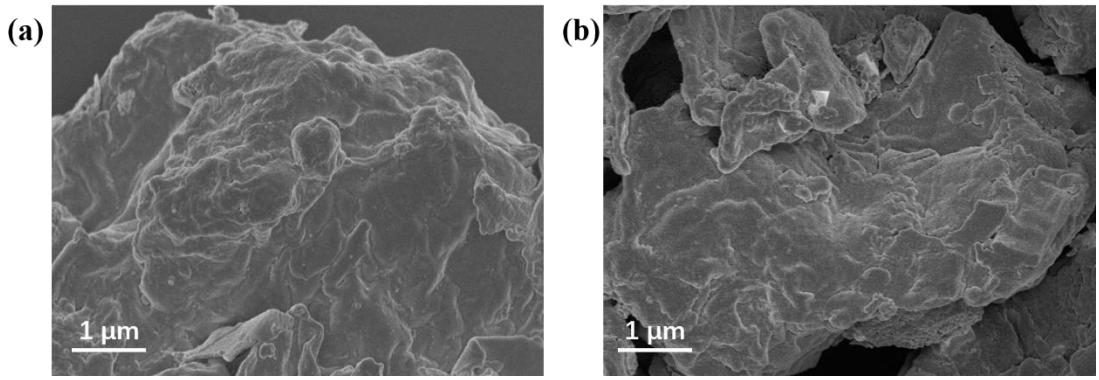

Fig. S1 SEM images of GL sample.

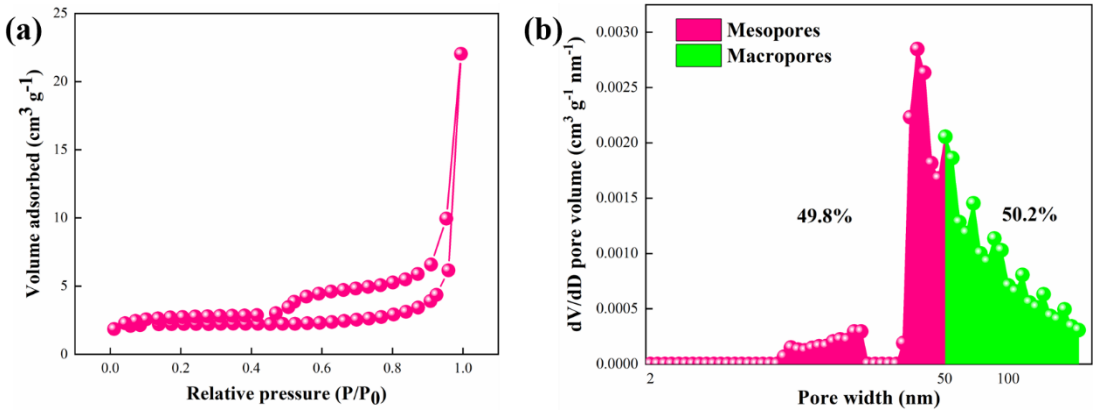

Fig. S2 The GL sample of Nitrogen adsorption/desorption isotherm (a) and pore size distribution (b)

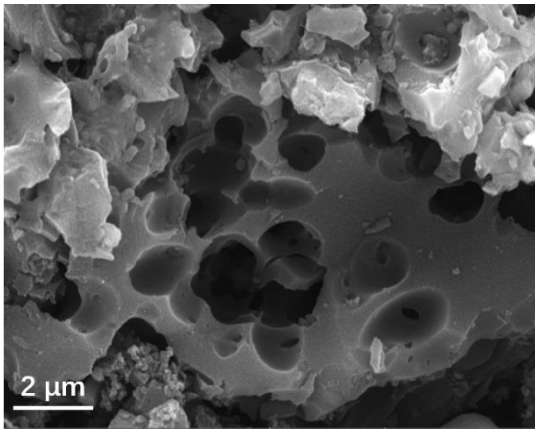

Fig. S3 SEM images of KGL electrode (KGL powder sample mixed with acetylene black, PTFE and coated on stainless steel mesh)

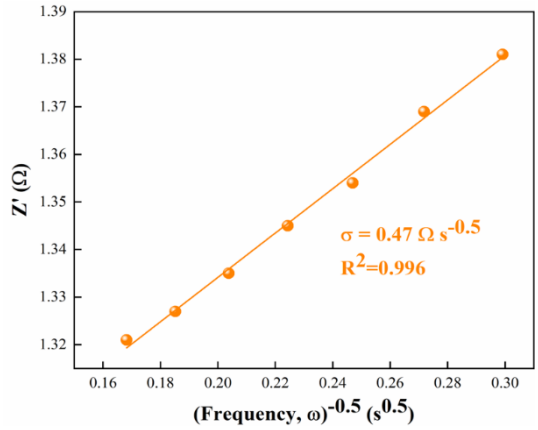

Fig. S4 The relationship between Z' and $\omega^{-0.5}$ in intermediate frequency region of KGL sample

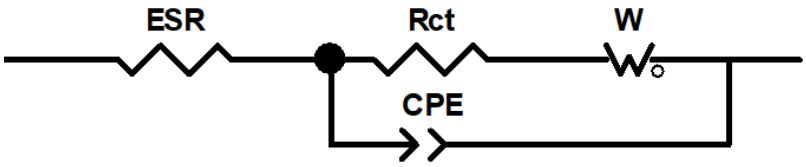

Fig. S5 Equivalent circuit model used to fit the experimental EIS data

Table S1 The ESR, Rct, W values of samples

Samples	ESR (Ω)	Rct (Ω)	W (Ω)
GL	1.46	0.097	0.46
KGL	1.16	0.077	0.30
KGL/ARS-5	1.07	0.18	0.82
KGL/ARS-E5	0.84	0.39	0.55

Table S2 The diffusion resistances (σ) and diffusion coefficient of H^+ ions (D_{H+}) of as-prepared samples

Samples	σ (Ω $s^{-0.5}$)	D_{H+} (cm^2 s^{-1})
KGL	0.47	$1.55*10^{-7}$
KGL/ARS-5	0.94	$3.87*10^{-8}$
KGL/ARS-E5	0.57	$1.05*10^{-7}$

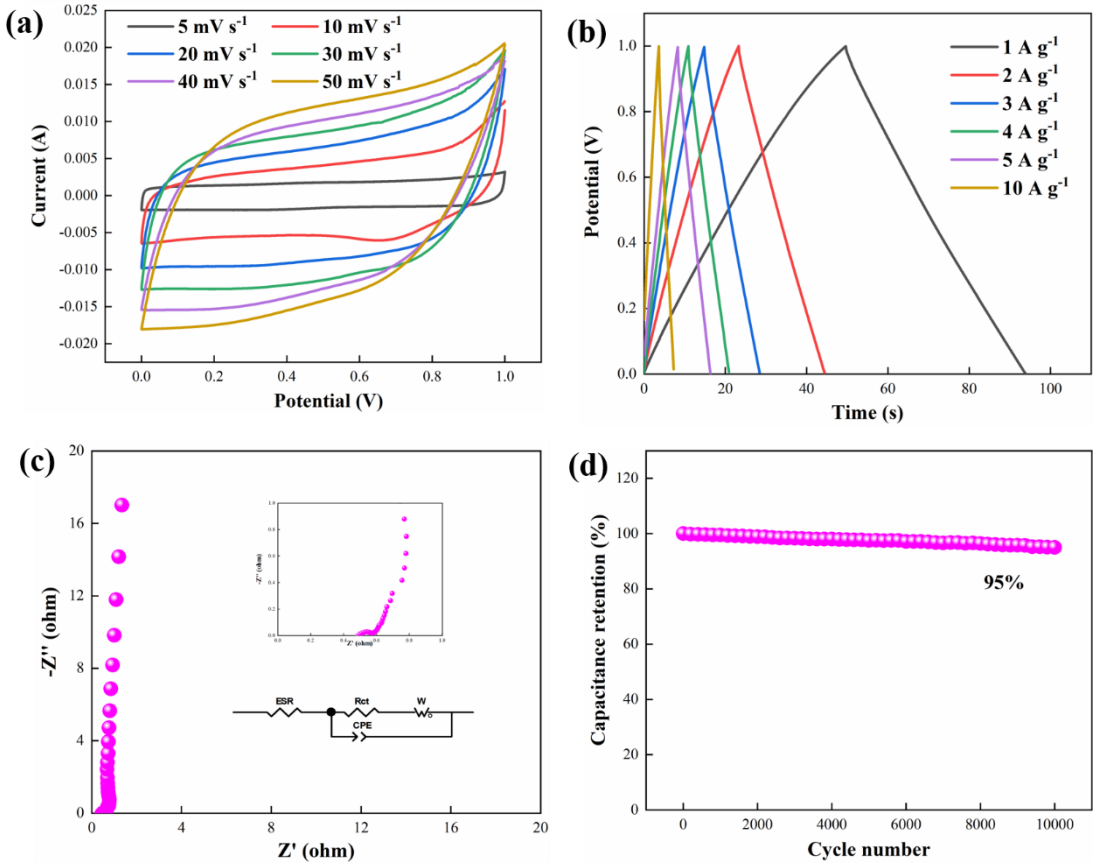

Fig. S6 Electrochemical properties of KGL//KGL symmetrical supercapacitors: CV curves at different scan rates (a), GCD curves at different current densities (b), Nyquist plot and equivalent circuit diagram (inset) (c), capacitance retention after 10000 cycles at 5 A g^{-1} (d)

Table S3 Specific surface area and pore structural characteristics of prepared samples

Sample	S_{BET} (m^2 g^{-1})	V_t (cm^3 g^{-1})	V_{mi} (cm^3 g^{-1})	V_{me} (cm^3 g^{-1})	V_{ma} (cm^3 g^{-1})	D_{av} (nm)
GL	7.2	0.0333	0.00194	0.0156	0.0157	19.045
KGL	2071.8	0.938	0.686	0.246	0.006	2.326
KGL/ARS-5	102.8	0.103	0.0132	0.0799	0.0099	5.764
KGL/ARS-E5	77.1	0.0472	0.0161	0.0294	0.0017	3.697

S_{BET}: BET specific surface area, calculated by using Brunauer-Emmett-Teller (BET) formula; V_t: total pore volume, calculated by Density functional theory (DFT) method; V_{mi}: microporous volume; V_{me}: mesoporous volume; D_{av}: average pore diameter.

Table S4 The element content in the as-prepared samples determined by XPS

Samples	Element content (%)			
	C 1s	N 1s	O 1s	S 2p
KGL	93.63	0.38	5.94	0.05
KGL/ARS-5	84.02	2.19	11.51	2.28
KGL/ARS-E5	82.23	3.16	12.08	2.53

Table S5 The ESR, Rct, W values of KGL//KGL/ARS-E5 and KGL//KGL

Samples	ESR (Ω)	Rct (Ω)	W (Ω)
KGL//KGL	0.52	0.037	0.12
KGL//KGL/ARS-E5	1.82	0.0076	0.17